

Ecoregion

Lower Gangetic Plains Moist Deciduous Forests



Area of the ecoregion
254,620 km²



Altitude
1-80 m



Annual rainfall
1,300-4,000 mm



Temperature
8°C-40°C



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Overview

The **Lower Gangetic Plains Moist Deciduous Forests** were once an expansive, dense, tall, diverse tract of forests extending across the gently sloping and undulating plains of the Ganga, and its network of meandering tributaries. These forests connected the freshwater swamps of the Sundarbans to the Himalayan foothills and the wet rainforests of northeast India. Sitting within a depressed basin surrounded by subtropical highlands, the low elevation lands are moist and humid throughout the year supporting *Shorea robusta* (sal) dominated forests interspersed with evergreen montane species punctuated by sedimented valleys with *Pandanus* (screwpine) marshes fed by constantly evolving river channels that skimmed, swept and scarred the landscape. Today these forests are reduced to small pockets along low hills while much of the fertile floodplains have been converted to paddy fields and human settlements holding some of the highest population densities in the world.

Ecological Restoration Projects in the Ecoregion

We are currently not aware of any projects located in this ecoregion. Please mail us on hello@era-india.org if you know of any projects that could be listed here.



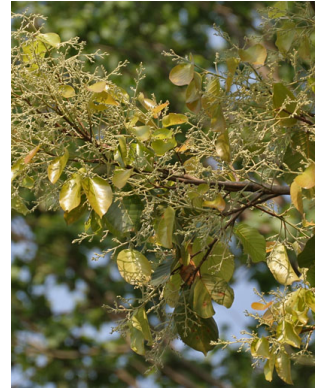
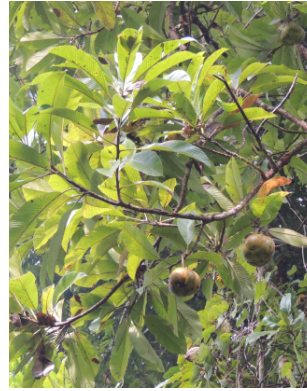
Marshy river banks, tall moist deciduous trees and large rain clouds rolling in from the bay of bengal.

Adjoining ecoregions

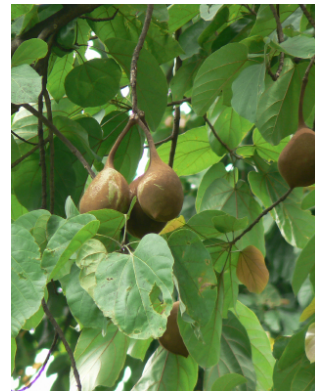
Towards the north this ecoregion transitions into the **Terai-Duar Savanna and Grasslands** and the **Himalayan Subtropical Broadleaf Forests**. The ecoregion is a continuation of the western **Upper Gangetic Plain Moist Deciduous Forests**. Towards the east these forests meet the **Brahmaputra Valley Semi-Evergreen Forests** and the **Mizoram Manipur Kachin Rainforests**. Southwards the plains rise up to meet the **Chhota-Nagpur Dry Deciduous Forests**, **East Deccan Moist Deciduous Forests** and the **Narmada Valley Dry Deciduous Forests**. The Moist forests of this ecoregion transition into the **Sundarban Freshwater Swamp Forests** that lie in the southeast.

Geography

This ecoregion is situated in the vast lower Gangetic plains and basins that cover an area of 254,620 km². Ecosystem wise, the region is contiguous from the junction of the Ghaghara and Ganga rivers up until the rising rainforest of Mizoram spanning a width of 800 km. This belt of moist forests are centred around the central thick, braided spine of the perennial Ganga river flanked by the dendritic array of meandering tributaries that feed into its course from the north and south. These larger tributaries, who themselves are fed by hundreds of smaller rivers and streams, form a fan of fluvial pathways, alluvial deltas, meander scars, wetlands, paleochannels, sedimented valleys and oxbow lakes. The hundreds of tributaries and the Ganga itself are in a dynamic flux of channel migration and evolution with constant convergence and divergence of routes over time within the low, nearly flat, sediment-rich floodplains. This belt extends 530 km latitudinally and gradually transitions into the Sundarban Freshwater Swamp Forests as the Ganga fans out into distributaries such as the Hooghly. Large southward flowing river systems include Koshi, Gandak and Faluhar rivers who themselves are fed by the himalayan glaciers. Large northward flowing rivers are namely the Sone and Kiul descending from the the granitic-lateritic highlands of central India. The depressed plains are almost flat and gently undulating with low hills that rise along the fringes of the floodplain. Elevation is predominantly between 1– 6 m asl and rises to 80 m along the hills. The braided plains and dense network of current river channels and dense scars of past movement are fed by the millions of tonnes of sediment carried down from the Himalayas consequently making the lower plains the region for accumulation, growth, and fluvial change.



Canopy Trees [left to right]: *Acrocarpus fraxinifolius*, *Aglaiia spectabilis*, *Dillenia indica*, *Shorea robusta*



Sub-canopy Trees [left to right]: *Antidesma acidum*, *Ficus semicordata*, *Firmiana colorata*, *Pterygota alata*



Shrubs [left to right]: *Alangium salvifolium*, *Aporosa octandra*, *Tabernaemontana divaricata*, *Meyna laxiflora*



Lianas [left to right]: *Abrus precatorius*, *Chonemorpha fragrans*, *Mallotus repandus*, *Marsdenia volubilis*

Geology and Soil

The geology is primarily a function of thick horizontal beds of silt, sand, and clay deposited over millennia. The base of these argillic horizons consist of regoliths beneath a layer of vertically stratified iron-oxide pisolites. These compacted basal layers are capped by a horizon of mudstone that supports the diverse, dynamic composite of near-surface layers above. The surface horizons are a mixture of networked stacks of peds (of various development stages), alluvial clay, mottles, gravelly sand, iron-magnesium nodules, vertical cracks and a thin layer of fine silts and organic matter. These layers have little structural integrity and maintain cohesion through water. The groundwater level is very close to the surface and the soils are saturated with water for much of the year within layers of high porosity. The composition, depth, and ratio of compounds within sediments are based upon the slope, age of the deposited layers, and the proximity to existing surface and subsurface water channels as well as regions of origin (from where material was originally eroded). Within more hilly areas, soils can either become a more hard red ferralitic loam or sandy loam that may form sandstone formations based on stratified and weathered sub-surface granite.



Flat fluvial plains of deep sediment, meandering rivers and paddyfields of the lower gangetic basin; Allahabad

Characteristic native plant species

Canopy trees

Acrocarpus fraxinifolius
Aglaiia lawii
Aglaiia spectabilis
Ailanthus integrifolia
Alangium chinense
Albizia lebbek
Albizia procera
Anthocephalus cadamba
Aphanamixis polystachya
Artocarpus chama
Artocarpus lacucha
Bombax ceiba
Butea monosperma
Casearia graveolens
Celtis tetrandra
Cephalanthus tetrandra
Crateva religiosa
Dalbergia sissoo
Dillenia indica
Duabanga grandiflora
Dysoxylum gotadhora
Elaeocarpus floribundus
Elaeocarpus varunua
Ficus benghalensis

Ficus racemosa
Garuga pinnata
Gmelina arborea
Grewia asiatica
Lagerstroemia hypoleuca
Lanea coromandelica
Litsea glutinosa
Litsea salicifolia
Macaranga peltata
Machilus glaucescens
Magnolia pterocarpa
Pterospermum acerifolium
Pterygota alata
Schima wallichii
Shorea robusta
Spondias pinnata
Strychnos nux-vomica
Syzygium formosum
Terminalia arjuna
Terminalia chebula
Terminalia myriocarpa
Tetrameles nudiflora
Toona ciliata

Sub-canopy trees

Aegle marmelos
Aglaiia perviridis
Antidesma acidum
Balakata baccata
Cinnamomum glaucescens
Croton tiglium
Cryptocarya amygdalina
Engelhardtia spicata
Ficus hispida
Ficus neriifolia
Ficus semicordata
Firmiana colorata
Goniothalamus sesquipedalis
Grewia sclerophylla
Litsea pungens
Macaranga indica
Maesa chisia
Phyllanthus emblica

Pueraria sikkimensis
Sapindus mukorossi

Vitex quinata
Wendlandia coriacea
Zanthoxylum budrunga

Characteristic native plant species















Shrubs

Alangium salvifolium
Aporosa octandra
Artabotrys caudatus
Atalantia missionis
Bambusa tulda
Boehmeria penduliflora
Bridelia stipularis
Buddleja asiatica
Callicarpa arborea
Catunaregam longispina
Croton bonplandianum
Eranthemum griffithii
Meyna spinosa
Mussaenda roxburghii
Meyna laxiflora
Pandanus unguifer
Tabernaemontana divaricata

Lianas

Abrus precatorius
Acacia pennata
Adenanthera microsperma
Aganope polystachya
Chonemorpha fragrans
Cissus quadrangularis
Cryptolepis buchmanii
Derris robusta
Entada phaseoloides
Ichnocarpus frutescens
Mallotus repandus
Marsdenia volubilis
Stixis suaveolens
Ventilago denticulata
Vincetoxicum indicum

Plant seasonality

J	F	M	A	M	J	J	A	S	O	N	D
											
											
											

Climate

A stable high humidity, high moisture, and high temperature distinguish the climate of the basin which is characteristically more tropical in nature from the surrounding elevated-highland subtropical belts. Humidity ranges between a minimum of 50% in the summer to 85% or higher through the remainder of the year. The region experiences an annual summer drought of 3–5 months with little to no rainfall and average temperature reaching between 38°C and 40°C with slow westerly winds. During these months, the landscape relies on the perennial water sources from the Ganga to sustain the moist ecosystems through periods of harsh deficits. Annual precipitation can be very high but is very variable spatiotemporally and between years, ranging from 1300 mm to 2800 mm and can even reach 4000 mm per annum in pockets further east. Within the ecoregion, high amounts of rainfall occurs in concentrated and short windows. More than 85% of precipitation is received in a span of 4 months between July and October. Intense rainfall creates the annual flooding of rivers, waterlogging the banks and depositing a new layer of sediment. These rains fall within the southwest monsoon and usually form large depressions or cyclonic systems rolling in from the Bay of Bengal. Temperatures average around 15°C during the winter months and frequently fall as low as 8°C and frost is uncommon. Fog and significant amounts of dew fall can occur during these months.

Natural vegetation

Moist deciduous forests of the lower Gangetic plain are tall forests with dominant *Shorea robusta* (sal) stands interspersed with a unique community of evergreen and deciduous trees that share biogeographic origins with the rainforests of the northeast and the broadleaf moist forests of the Himalayan foothills. These forests can be split into four layers including the emergent storey (35–40 m) consisting of a few trees followed by the dense main canopy (20–30 m) where the community of dominant species (sal and associates) are situated. The sub-canopy (8–15 m) is characterised by a more unique, variable and diverse assemblage of evergreen species, and specialist trees of smaller stature. The shrubs and herbaceous growths (e.g pteridophytes) comprise the dense but patchy understory (2–8 m). Tree density is more dense than moist deciduous forests lower south falling between 500–580 individuals per hectare. Lianas are large and dense with more than 34 species present but congregate in more open forests. These moist deciduous forests host plenty of epiphytic communities on their branches including orchids, pteridophytes, and mosses. Up to 95 species of

mosses have been documented within mature tracts including some significant species from *Lejeunea*, *Mastigolejeunea*, *Riccardia*, *Schiffneriolejeunea*, *Frullania* and *Porella* genera. Some important orchid species include *Bulbophyllum afne*, *B. lobbii*, *Coelogyne suaveolens*, *Dendrobium tortile*, *Micropera pallida*, *Mycaranthes floribunda*, *Pinalia acervata*, *Pinalia globulifera*, *Thelasis khasiana* and *Trichoglots ramosa*. Waterlogged areas and wetlands demarcate and punctuate the dense forests along the banks of rivers, oxbow lake and paleo channels where *Myristica* spp. and *Pandanus* spp. form unique transitional habitats.

Variation within ecoregion

Lower Gangetic Plains Moist Deciduous Forests cover a large area of land both within India and the majority of Bangladesh within the plains of the Padma and Brahmaputra rivers. However, more than 90% of forests have been completely deforested from as early as 500 BC to make way for an area with the highest population densities in



Left to right: Bengal slow loris, Swamp deer



Left to right: Gangetic river dolphin, Gharial

the world subsisting on a large expanse of paddy (rice fields) that make up much of the floodplains. Thus the once mighty stands of moist deciduous forests have been relegated to historical records. Existing forests of this type within India are primarily found in Tripura and in pockets along the lower Himalayas. Thus it is near impossible to get a comprehensive grasp of floral communities and forest types of areas of the basin particularly to the south and west.

There are however landscape level influences that still form microclimates and create spatiotemporal gradients irrespective of biogeographic influences. These include the distance from the coastline and the alignment to the hill ranges. Lands closer to the Bay of Bengal have higher humidity and have more stable temperatures throughout the year with milder summer and warmer winters. Additionally land closer to the coast lie in proximity to the river deltas and thus have 'younger' alluvial soils that are more dynamic, less structurally stable, contain higher amounts of sand and fine silt and are more waterlogged. Land further up the river and closer to the hills, have older alluvial beds that have been compressed and settled, these areas hold more empty sediment valleys, scars, and lakes and also have more mature geological horizons and soil with harsher summer and cooler winters allowing for the expansion of higher elevation species into these lands. Within these plains, new alluvial zones are present along the river channels alone.

There are very clear rainfall gradients within the flat plains with little to no orographic obstructions. However these differences get homogenised by the intricate fluvial network that distributes and disperses the water across the entire plain making up for deficiencies and minimising excess.

Plant seasonality

The moist forests of these Ganga plains have high diversity of plants from various different biogeographic backgrounds including drier rugged highlands, subtropical hills, rainforests of the northeast and freshwater swamp forests. A common linkage between all the various cyclic patterns is the annual drought period which limits soil moisture and dictates the energy budget of plants away from riparian zones. Thus the initiation of cycles are roughly based around the summer drought for most species. However it is important to note that many of the evergreen communities have low connections to annual seasonality and rather follow more biological or inherent multi-year cycles.

Pollination and seed dispersal ecology

Chief pollinators are arthropods, mainly bees (hemiptera) and moths/butterflies (lepidoptera). Pollination also occurs by a multitude of bird species that are attracted to the copious production of nectar. Most flowers are generalised to pollination by multiple species. Fruits are equally dispersed by wind as by frugivores. Animal dispersed fruits within these moist forests are prominently large and fleshy, hosting a multitude of large birds, primates and small mammals.

Animal life

Historically these forests were home to large populations of tigers and elephants which have all but disappeared from the landscape. However, remaining pockets hold important populations of smaller mammal species such as the slow loris, swamp deer, and fishing cat. The Ganga river is also home to the elusive and threatened Gangetic river dolphin, along with the Gharial in select pockets. These moist forests are home to an intersection of lower Himalayan species, riverine and wetland species and montane forest species extending from the northeast including more than 380 species of birds. Some endangered species include the Bengal Florican, Rufous-necked Hornbill, Great Hornbill, White-rumped Vulture, Ferruginous Pochard and Lesser Adjutant Stork, and Indian Skimmer. Additionally the forests host more than 200 species of moths and 60 species of butterflies.

Conservation

Less than 3 percent of the land within this rich belt is under forest cover and only 0.03% of forests are intact without significant disturbances. Agrarian practices have cleared and changed the entire complexion of these ecosystems over centuries resulting in the extinction of localised microhabitats. Agrarian expansion has now been replaced by urbanisation with urban areas increasing by 20% over a 15 year period within these floodplains. Existing forests are being threatened by tea, teak, rubber and oil palm plantations. Additionally, large populations of people living in Tripura still rely on shifting cultivation processes or jhum that is reliant upon forest resources which over time has had a significant effect on vegetation diversity and stand structures of forests. Jhum cultivation however supports greater natural ecosystem diversity than plantation ecosystems.

Important Protected Areas in the Ecoregion

1. Buxa wildlife sanctuary
2. Clouded Leopard National Park
3. Rajbari National Park
4. Trishna Wildlife Sanctuary
5. Sepahijala Wildlife Sanctuary
6. Rowa Wildlife Sanctuary
7. Gumti Wildlife Sanctuary

Ecological Restoration Projects in the Ecoregion

We are currently not aware of any projects located in this ecoregion. Please mail us on hello@era-india.org if you know of any projects that could be listed here.

Acknowledgements

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[cover] Ecoregion Map: A. P. Madhavan

[Pg 1] Sangu River: Fayed Masudkhan

[Pg 3] *Acrocarpus fraxinifolius*: Forestowlet

[Pg 3] *Aglaia spectabilis*: Aparajita Datta

[Pg 3] *Dillenia indica*: A.J.T Johnsingh

[Pg 3] *Shorea robusta*: J.M.Garg

[Pg 3] *Antidesma acidum*: दिवा दत्त

[Pg 3] *Ficus semicordata*: Rohit Naniwadekar

[Pg 3] *Firmiana colorata*: Haneesh KM

[Pg 3] *Pterygota alata*: Dinesh Valke

[Pg 3] *Alangium salvifolium*: Dinesh Valke

[Pg 3] *Aporosa octandra*: Y]

[Pg 3] *Tabernaemontana divaricata*: Vengolis

[Pg 3] *Meyna laxiflora*: Vengolis

[Pg 3] *Abrus precatorius*: MGB CEE

[Pg 3] *Chonemorpha fragrans*: Dinesh Valke

[Pg 3] *Mallotus repandus*: Vinayaraj

[Pg 3] *Marsdenia volubilis*: J.M.Garg

[Pg 4] Ganges River in Allahabad: ptwo

[Pg 9] Bengal slow loris: Ian Dugdale

[Pg 9] Swamp deer: David Raju

[Pg 9] Gangetic river dolphin: Kukil Gogoi

[Pg 9] Gharial: Adam Jones

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Key References

- Sarkar, A., & Das, A. P. 2017. Analysis of floral dynamics in Jainti Forest of Buxa Tiger Reserve, West Bengal, India. *Pleione* 11: 216 - 239.
- Singh, L. P., Parkash, B., & Singhvi, A. K. 1998. Evolution of the Lower Gangetic Plain landforms and soils in West Bengal, India. *CATENA*, 33: 75–104.
- Adit, A., Koul, M., & Tandon, R. 2019. New distribution records in the orchid flora of Tripura, India. *Journal of Threatened Taxa*, 11: 14876–14885.
- Darlong, L., & Bhattacharyya, D. 2014. Diversity and field status of lianas in Tripura, India. *Journal of Threatened Taxa*, 6: 6703–6710
- Debnath, B., Das, S. K., & Debnath, A. 2021. Diversity, community characteristics and regeneration status of tree species in Rowa Wildlife Sanctuary: An Indo-Burmese Hotspot—Tripura, North East India. *Vegetos*, 34: 153–160
- Ghosh, A., & Joshi, P. K. 2014. A comparison of selected classification algorithms for mapping bamboo patches in lower Gangetic plains using very high resolution WorldView 2 imagery. *International Journal of Applied Earth Observation and Geoinformation*, 26: 298–311.
- Kumar, A., & Venu, P. 2018. A sketch on floristic diversity of Buxa Wildlife Sanctuary, Alipurduar, West Bengal, India. *Indian Journal of Forestry*, 41: 255–259.
- Majumdar, K., Shankar, U., & Datta, B. K. 2012. Tree species diversity and stand structure along major community types in lowland primary and secondary moist deciduous forests in Tripura, Northeast India. *Journal of Forestry Research*, 23: 553–568.
- Majumder, J., Lodh, R., & Agarwala, B. K. 2012. Variation in butterfly diversity and unique species richness along different habitats in Trishna Wildlife Sanctuary, Tripura, northeast India. *Check List*, 8: 432–436.
- Nad, C., Roy, R., & Roy, T. B. 2022. Human elephant conflict in changing land-use land-cover scenario in adjoining region of Buxa tiger reserve, India. *Environmental Challenges*, 7: 100384.
- Sam, K. 2022. Modelling the effectiveness of natural and anthropogenic disturbances on forest health in Buxa Tiger Reserve, India, using fuzzy logic and AHP approach. *Modelling Earth Systems and Environment*, 8: 2261–2276.
- Singh, S. K., & Kumar, S. 2016. A Preliminary Study on Liverworts and Hornworts of Tripura, North-East India. *Nelumbo*, 58: 130–151.
- Sivakumar, S., Varghese, J., & Prakash, V. 2006. Abundance of birds in different habitats in Buxa Tiger Reserve, West Bengal, India. *Forktail* 22:128
- Talukdar, S., Singha, P., Mahato, S., Praveen, B., & Rahman, A. 2020. Dynamics of ecosystem services (ESs) in response to land use land cover changes in the lower Gangetic plain of India. *Ecological Indicators*, 112: 106121.

One Earth Ecoregion Snapshot

<https://www.oneearth.org/ecoregions/lower-gangetic-plains-moist-deciduous-forests/>



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